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Learning from Television: A Research Review

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Babette Moeller

Table of Contents

Introduction

Traditionally, educators have perceived television as not particularly beneficial to literacy development. Concerns were fueled by findings suggesting that with the introduction of television people spend less time reading books and reading scores decline (e.g., Corteen, 1986; Robinson, 1972; Werner, 1971). However, as our society is striving to make adjustments to the decline in literacy skills and new ways of learning and teaching are being explored, educators are becoming interested in exploring the educational potential of television and video for teaching basic literacy skills such as reading, writing, and math.

The interest in television as an educational medium has increased for several reasons. First, existing educational television programs that were developed to enhance the literacy development of both children (e.g., *The Electric Company, Sesame Street, Ghostwriter*) and adults (e.g., television-supported distance learning programs from the Open University in Great Britain, second language programs produced by TV Ontario) have been quite successful in achieving their intended outcomes (e.g., Bates, 1983; Bryant, Alexander, & Brown, 1983; Soudack, 1990). Second, because television is a very accessible medium, it has the potential to reach learners that have not been able to participate in traditional adult literacy programs. Television is accessible both in terms of its technology and in terms of its content. By 1985, 99% of all US households had a least one television set (Nielson Reports, 1986). Moreover, viewers are intimately familiar with the content of television and tend to associate it with pleasurable experience because of its power to entertain (Bates, 1983). Finally, the development of new visual technologies, (e.g., video recording and playback, CD-ROM and videodisk technology, multimedia computer technology) makes it possible to provide users with more control and interactivity and thus to adapt televised instruction to the needs of a variety of learners and learning styles.

A question of central concern to educators interested in using television for literacy education is ‘what do people learn from television’? This paper reviews existing research on learning from television in an attempt to address this question, and to assist in the planning for the development of television programming and curricula for adult literacy education.

Material Reviewed

The materials upon which this review is based include books, chapters, journal articles and published and non published reports from the academic disciplines of psychology, sociology, anthropology, and from applied multidisciplinary fields such as education, communication, distance learning, and advertising research. On-line literature searches were conducted using the following research databases:

ERIC (Educational Resources Information Center) Resources in Education (RIE) and Current Index to Journals in Education(CIJE) (1980-present);
PsychLit (1974-current);
RLIN/Eureka Anthropological Literature (1984-present);
Sociofile (1974-current).

These databases were queried using combinations of one or more of the following keywords: Television, literacy, language learning, adult education, adult learning, and learning. The bibliographic information obtained through these searches was inspected and articles were selected for inclusion in this review if they reported empirical work on adults' learning from television and video (including but not limited to literacy and second language learning). Articles about children and instructional television were reviewed also, especially if they touched on literacy and language learning.

Learning from Television: The Potential

The research literature suggests that the content of television can have four broad types of effects on people. They include behavior, attitudes, beliefs and values, knowledge, and cognitive skills. Each of these will be discussed in turn. Following this, I will summarize the potential impact of television on literacy learning that has been documented by research on existing literacy programs.

Behavior

Behavioral effects of television have been most extensively studied in advertisement research and in research on the impact of television on aggressive behavior. The link between television and behavior has often been difficult to establish (especially through observational studies). One of the problems is that learning occurs usually in at least two stages: acquisition and performance (cf., Bandura, 1973; Williams, 1981). Whether or not learning has occurred is usually demonstrated through people's performance. It is possible, however, for a person to acquire a certain behavior without necessarily performing it for the researcher. In other words, failure to perform a given behavior does not mean that learning did not occur.

Researchers have proposed three major mechanisms for the behavioral effects of television. They include imitation, arousal, and disinhibition. There exists evidence supporting all three of these mechanisms, so they should be thought of as complementary rather than competing explanations for the effects of television on behavior.

Imitation, or learning through observation, is a mechanism that has been proposed by social learning theory (e.g., Bandura, 1973; 1986). According to this theory, behavior performed on television is being observed and imitated by the viewers. Since its initial formulation in 1963 (Bandura, Ross, & Ross, 1963), social learning theory has been continuously elaborated. In a recent version, Bandura (1986) describes imitation as being mediated by a variety of cognitive and motivational processes that determine whether or not modeled behavior will be actually performed by the observer. Far from being simple response mimicry, imitation is now thought of as depending on factors such as whether or not the observer is attending to the model, how well the observer can remember and execute the modelled behavior, and the incentives and rewards associated with carrying out the modelled behavior.

Several investigators have invoked the concept of arousal to explain the effect of television on behavior (cf., Condry, 1989). Arousal has been defined as "a unitary force that energizes or intensifies behavior that receives direction by independent means" (Zillman, 1982). Of particular interest for explaining behavioral effects of television are those arousal processes that are associated with affective and emotional reactions. Zillman (1982) refers to this from of arousal as autonomic. Autonomic arousal is usually measured through heart rate (acceleration and deceleration), systolic and diastolic blood pressure, or skin conductance. According to proponents of the arousal theory, television can either elevate or reduce viewers' arousal levels. Research has shown that certain programs, such as erotica, comedy, drama, and sports (for some viewers) elevate viewers' arousal levels, whereas nature shows have been shown to decrease viewers' arousal levels (Zillman, 1982). The extent to which a viewer will become aroused by a particular program will depend on the viewer's initial arousal level (e.g., Sternbach, 1966) and how frequently the viewer was exposed to the arousing material (Reifler, Howard, Lipton, Liptzin, & Widmann, 1971). Television viewers who have a low level of arousal initially will have much larger reactions to an exciting program than viewers who are already aroused when they begin watching. Moreover, frequent exposure to arousing material may lead the viewer to habituate to the material, and thus to decrease his or her response to it.

A third mechanism that has been proposed for the behavioral effects of television is disinhibition (e.g., Berkowitz, 1974). According to this theory, repeated exposure to socially sanctioned behaviors may increase the likelihood of viewers to let go of the constraints on their actions and to display such behavior. This theory suggests that television not only influences the acquisition of novel behaviors, but also may have an effect on whether or not already acquired behavior patterns will be performed. As such, this theory is particularly relevant for explaining the impact of

television on adults. Compared to young children, adults usually have a well-developed repertoire of response patterns, so the major impact television may have on their behavior is in terms of performance rather than acquisition.

Attitudes, Beliefs, Values

There exists a large body of research that suggests that television has an important impact on people's attitudes, beliefs, and values (e.g., Gerbner, Gross, Morgan, & Signorelli, 1980; Gerbner, Morgan, & Signorelli, 1986; Signorelli, Gross, & Morgan, 1982). Particularly well documented is the effect of television on people's attitudes and beliefs about violence and different social groupings (e.g., women, ethnic minorities, older people). According to George Gerbner and his colleagues who conducted much of this research, television cultivates a common outlook or world view among its viewers. The more television a person watches, the more likely he or she is to accept the premises and facts of television reality as if they were facts of the world of everyday reality. For example, since violence is prevalent on television, heavy television viewers often overestimate the prevalence of violence in their lives. Gerbner refers to this process as mainstreaming. While Gerbner's theory is not very specific about the underlying processes for cultivation or mainstreaming, this theory does make two specific claims. The first is that television exerts its influence on people as a whole (independent of particular programs). The second is that the more television people watch the more they will be affected. While the claim that television affects people's attitudes is well documented there is little evidence available to support Gerbner's more specific claims about how television exerts its influence. In fact, both of these claims have been disputed and alternative models have been proposed.

First, Greenberg (1988) has proposed that a single program or character that stands out from other programs or characters can under certain circumstances counteract the messages of mainstream television. According to this view it is not so much the quantity but the quality of the messages that count. An example that Greenberg uses to illustrate his point is *The Bill Cosby Show*. The way African-Americans are portrayed in this program, as sophisticated, well-off professionals, is much different from how they are portrayed on television as a whole. He suggests that the portrayals of blacks in this show may supersede or overwhelm the black images derived from other shows that portray them in less distinguished, less interesting, and less positive characterizations.

The second contention with the specific claims of the cultivation theory is that there may not be a linear relationship between the amount of viewing in televisions' effect on people's attitudes and beliefs. As an alternative,

Williams (1981) has proposed a threshold model. According to this model, television may exert its influence only in a certain range of viewing experience. Below this range, little or no effect may occur, and above this range television may have no additional impact.

In sum, research suggests that television can have an important impact on people's attitudes, beliefs, and values. However, exactly how television exerts this influence is not well understood yet.

Knowledge

Television is rich in both factual and fictional information. While there is little question that television, a medium designed to convey information, has an effect on people's knowledge base, there exists relatively little research on this issue (e.g., Bryant, Alexander, & Brown, 1983). It has been proposed that television can have an impact on both the formation and organization of viewers' concepts (e.g., Anderson & Collins, 1988). Relevant evidence comes from advertising research and research on the effects of social role portrayals.
For instance, television has been shown to contribute both to the formation and change of gender role concepts in children (e.g., Calvert & Huston, 1987; Johnston & Etema, 1982). Similarly, food commercials have been shown to influence children's knowledge about the characteristics of certain foods and their concepts of what constitutes good nutrition (Atkin, 1982).

The underlying processes by which changes in viewer's knowledge base take place are not well understood. Possible mechanisms for the formation of concepts may include memorizing images of category instances encountered on television, or abstracting prototypes or rules from them. Arousal is another mechanism that has been invoked to explain television's impact on information acquisition. Zillman (1982) discusses cortical arousal (i.e., those arousal processes that serve attention, perception, and response preparation) in this context. He proposed that certain features of television programs, such as rapid pace or visual effects may produce cortical arousal and thereby create attentiveness in the viewer, which in turn may facilitate his or her acquisition of information.

Cognitive Skills

There are a variety of ways in which television, both in terms of its content and its formal features or cinematic codes, can influence cognitive skills. It has been proposed that television has an effect on viewers' spatial abilities,imagination, and task perseverance. For instance, Salomon (1979) has demonstrated that watching slow zooms in to details of a large picture teaches children visual analytic skills. Similarly, watching changes in camera perspectives can enhance children's' spatial perspective taking.

Studies comparing the effects of different media have shown that television can promote special inferential processes in children, such as inferences based on audio-visual information and actions (Beagles-Roos & Gat, 1983). Research has also demonstrated a relationship between the pacing of television programming and task persistence. Whereas fast-paced programming (such as the typical Saturday morning children's programs) can make children more impulsive, slower paced programs (such as *Mr. Rogers' Neighborhood*) have been shown to increase their persistence in everyday school activity (Friedrich & Stein, 1973).

The mechanisms that have been proposed to explain how television influences cognitive skills are similar to the ones offered to explain the behavioral effects of television. This is perhaps not surprising, as cognitive skills are sometimes thought of as internal behaviors. Salomon (1979) has proposed that formal features of television (such as camera movements) can model cognitive processes for the viewer. According to this account cognitive skills are being learned through observation and imitation. Another possible mechanism is that television may help to activate already existing mental skills in the viewer. For instance, Brown (1986) has argued that television may provide viewers with a rich storehouse of visual images that they may draw upon when engaged in imaginative thought. The available research is consistent with both of these explanations, so they should be thought of as complementary rather than as competitve.

In sum, television has the potential to have a broad impact on the viewer. Can this potential be garnered for literacy education? This question will be addressed next.

Literacy Learning from Television

There exists now a fair amount of educational television programs that were designed to enhance basic literacy skills, including reading, writing, speaking, listening and basic math skills. Most of these programs were targeted to young children. What can viewers learn from such programs? According to the research that accompanied the development of some of these programs, television has been shown to affect literacy-related behavior, attitudes, knowledge and specific literacy skills as outlined below.

Impact on behavior. There exists little research that has addressed the impact of television-based literacy programs on literacy-related behavior. One reason for this may be the difficulty of observing and measuring such behavior. The scarcity of research should not be taken to imply that literacy programs do not have an effect on viewers' behavior. There are many ways in which television could have an impact on viewers' literacy

practice. For instance, watching the dramatization of a novel may encourage viewers to get the book and read it. Similarly, the content of a given program may compel viewers to write letters to their government representatives. Existing research has shown that programs like *Ghostwriter* and *The Electric Company* are successful in getting their audience (young children) to read along when text appears on the screen (Bryant et al., 1983; Wilder & Yotive, 1993). Moreover, there is some evidence that the bilingual program *Carrascolendas*, which was designed to teach young Spanish-speaking children Spanish language and promote pride in Spanish culture, increased the use of Spanish language among their viewers (Bryant et al., 1983).

Impact on attitudes. Several studies have demonstrated that literacy programs can be successful in changing viewers' attitudes about reading, writing and math. For instance, the program *Ghostwriter* has been shown to enhance children's awareness of the relevance of reading and writing (Hall, Williams, Cohen, & Rosen, 1993). Similarly, there is some evidence that the program *Infinity Factory* has been successful at changing children's attitudes about math (Bryant et al., 1983). Television-based literacy programs also can have a powerful impact on how viewers view themselves and their culture. The program *Carrascolendas*, for example has been demonstrated to enhance target viewer's pride in their Spanish heritage (Bryant et al., 1983).

Impact on knowledge. Literacy programs also can make an important contribution to viewers' knowledge base. Some of the effects that have been documented are word learning and the acquisition of cultural knowledge. Word learning has been shown to occur if new words are presented verbally (Rice & Woodsmall, 1988), or in written form through captions (Bean & Wilson, 1989; Neuman & Koskinen, 1992). An increase in knowledge about Spanish culture and history has been documented for viewers of the program *Carrascolendas* (Bryant et al., 1983).

Impact on literacy skills. The development of viewers' literacy skills is perhaps the most important goal of most literacy programs. Improvements in reading skills have been documented for viewers of *The Electric Company* (Ball & Bogatz, 1973). Similarly, viewers of the programs *Square One TV* and *Infinity Factory* have been shown to increase their mathematical problem solving performance (Bryant, Alexander, & Brown, 1983; Hall, Etsy, & Fisch, 1990). Exactly how these programs influence viewers' literacy skills is not well documented. It appears that at least the math programs facilitate the use of already existing skills.

Together, the research reviewed in this section suggests that television has a great potential for enhancing learning in general and literacy learning in

particular. There are multiple ways in which television can influence how and what viewers learn. The use of television per se, however, does not guarantee that learning occurs. Perhaps the most important message that can be derived from available research is that whether or not learning occurs, is dependent on who is watching, how the viewer is watching television, how the program that's being watched is designed, and the context in which the program is being watched. In the following section, we will review the research on how variations in the audience, their viewing processes, the design of the program, and the viewing context influence learning outcomes, in particular for literacy learning.

Learning from Television: Mediating Variables: *Audience*

The group of adults in need of literacy education constitutes a very diverse audience. They can differ in almost any descriptor that has been used to characterize this population (e.g., Kirsch, Jenkins, Jungeblut, & Kolstad, 1993), such as age, gender, race, ethnic and cultural background, linguistic background, socioeconomic status, job status, marital and family status, educational background, literacy level, preconceptions about the television medium, motivation for getting involved with literacy education, and so on. In other words, adult literacy learners can be young adults, and people of old age; women and men; blacks and whites; people from different subcultures within the U.S., and immigrants from any nation of the world; people for whom English is a first language, and people for whom English is a foreign language; people who live in poverty, and people who are well off; people who had only a few years of formal education, and people who hold graduate degrees that were earned in another country; people who have no jobs at all, and people who hold several jobs at the same time; people who are single, and people with a large family to support; people who cannot read and write, and people who have some basic reading and writing skills; people who view television as a source of light entertainment, and people who take television seriously as an educational medium; people who do not want to get involved with literacy education, and people who want literacy education for a very specific purpose. To what extend do these differences have an influence on what people learn from television?

While many of the above mentioned variables have not yet been systematically examined, the existing research suggests that several of them make a difference in terms of what viewers learn from television:

Age. This variable has been most extensively studied compared to all other audience characteristics. The available research suggests that age can have an important impact on how well information will be remembered. For instance, Hill, Crook, Zadek, Sheikh, & Yesavage (1989) compared the memory performance of young (21-49 years),

middle-aged (50-69 years), and elderly (70+ years) adults after watching a 6-minutes simulated news program. They found that older adults recalled less information than the younger aged groups. Similar results were obtained by Stine, Wingfield, & Myers (1990).

Stine et al. (1990) also documented an interesting interaction between the age of the viewer and the complexity of the television program. They compared younger (college students) and older adults' (63-83 years) memory performance in three conditions: a) regular television presentation (audio and visual information), b) listening to the audio track of the news segments only, and c) listening to the audio track and reading a transcript of it. Stine et al. found an important age difference: Younger adults showed improved recall when the spoken information was augmented by written or visual information, while older adults did not benefit from this bisensory augmentation. Stine et al. argue that these age differences are due in part to the fact that multisensory information strains the working memory capacity of older adults. In support of this explanation there is some evidence that suggests that multisensory presentations (using audio and video together) demanded more attentional capacity from viewers than presentations using audio or video alone (Thorson, Reeves, & Schleuder, 1985). Alternatively, it is possible that learners of different ages approach the television medium with certain processing biases. For instance, Hayes & Birnbaum (1980) have shown that while young children seem to prefer the visual over the audio channel, college students tend to pay attention to both channels simultaneously. It is possible that older adults, especially since they did not grow up with television, may have a stronger preference for attending to the audio channel.

The finding that older people had more difficulties processing bisensory presentations, however, should not be taken to imply that older adults will not benefit from these kinds of presentations at all. For example, it is possible that older adults need more time to process multisensory information than what the pace of typical news programs allows. In fact, Brown, Brown, & Danielson (1975), in a study in which adult viewers watched segments of instructional television, found that older viewers tended to complain more about the pace of the program than younger viewers.

Educational background. Viewers' educational background also seems to make a difference in terms of how well information presented on television will be remembered. For instance, Stokes & Pankowski (1988), examining the memory performance of older adults (50+ years) after informally watching a television documentary, found that viewers' recall was related to their educational level. The higher their educational level,

the more information they recalled. Similar results were obtained by Findahl and Höijer (1985) investigating the effects of prior knowledge on adult viewers' memory of television news segments. Level of knowledge was related to recall of information from the news program. The more knowledgeable viewers were about the topic of the news stories, the better they would remember them. Hobbs (1986) found that teh effects of prior knowledge may interact with the structural characteristics of the television program. In his study, adults with high prior knowledge outperformed adults with low prior knowledge when recalling information from news segments in which the audio and video track did not match. However, Hobbs also demonstrated that visual-verbal synchrony can help viewers with low prior knowledge to perform as well as learners with high prior knowledge. These results suggest that the differential effects of prior knowledge can be compensated for by decreasing the structural complexity of television programs.

Literacy level. Another characteristic that has been related to viewers' memory for information presented on television is their literacy level. Stauffer, Frost, & Rybolt (1978) compared literate adults (college students) with adult nonreaders (participants in an Adult Basic Education program) in terms of how well they remembered information from a news program. They found that literates recalled significantly more news stories than the illiterates. While these results may be due to the fact that illiterates remember information less well than literates, it also possible that the difficulties for illiterates were more related to understanding the language used by the news casters and writers. Stauffer et al. (1978) point out that the oral difficulty of television news (complex sentence structure, multisyllabic words, use of highly specialized vocabulary) may present a considerable challenge to illiterates. A related issue is that of pace. The problem of typical news programs may not just be its complexity, but also its pace. It may be possible that people who are less literate can deal with complex news programs if they were presented at a slower pace. Support for this line of reasoning comes from Brown et al. (1975) who conducted a study of adult viewers learning form instructional television segments. They found that viewers who were weak in reading ability were more likely to complain about the pace of the program segments than viewers with strong reading ability.

Viewers' literacy level also may make a difference in terms of how much they will benefit from captioning. Neuman (1990), in a study with bilingual seventh and eighth graders, found that students who were at least fluent in English gained more vocabulary knowledge from English captions than students who were of limited English proficiency. However, Markham (1989), in a study with adults, found that captioning equally benefitted the performance of beginning, intermediate, and advanced ESL

students on a multiple-choice reading comprehension test. Markham's findings appear counterintuitive. The discrepancy of his findings from the results obtained by Neuman could be explained by how learners were classified in these studies. Since Markham did not directly assess the English fluency of his subjects, it is possible that his beginning and intermediate ESL subjects were fluent enough in English to benefit from the captioning. Alternatively, it is possible that adults compared to children have developed more effective strategies for utilizing visual cues to make sense of unfamiliar words, which would allow them to compensate for the lack of English fluency. Whether or not adults' English fluency has indeed an influence on the extent to which they will benefit from captioning remains an unresolved issue at the present time.

Preconceptions about the television medium. The results of several studies suggest a link between viewers' preconceptions about the television medium and learning outcomes, at least for children (e.g., Salomon 1981, 1983a, 1983b, 1984). Viewers who perceive television as an easy medium that does not require much mental effort tend to learn less from television programs than viewers who take television more seriously as an educational medium. Salomon (1981, 1983a, 1984) has linked the effects of preconceptions about the television medium to the expenditure of mental effort. Viewers who perceive television as an easy medium will expend less mental effort and process information passively, whereas viewers who take television more seriously will expend more mental effort and engage in active processing. Adult viewers (college students) have been shown to have preconceptions about television that are similar to those of children (Salomon, 1983b). While a direct link between adults' preconceptions about television and their learning outcomes has not been empirically demonstrated yet, it seems reasonable to assume that such a link exists for adults also.

Viewers' preconceptions about television have been shown to vary to some extent depending on their cultural background and the type of program involved. Salomon (1983b) has found differences in the perceived ease of learning from television between American and Israeli children. American children tended to take television less seriously as a medium that requires some cognitive effort and as a source of useful information than their Israeli counterparts. This may reflect the fact that programming on U.S. television is dominated by light entertainment. However, viewers' preconceptions about the television medium have also been shown to vary with the type of program involved. Kunkel and Kovaric (1983) have shown that adult learners (college students) have different preconceptions of educational materials than they have of entertainment materials. The subjects in this study reported that they would invest more effort in processing a program designed for the Public Broadcasting Service (PBS)

than in processing a program designed for commercial television. Similarly, Salomon (1983b), in a study with college students found that viewers make a distinction about the amount of mental effort required to process programs that differ in content. For instance, viewers indicated that processing the news would take more mental effort than processing a sports program. Finally, Cennamo (1992) has demonstrated that viewers associate specific learning outcomes with television. In her study college students were asked about the ease with which they could achieve various learning outcomes with different media (interactive video, computer, television, books). She found that adult viewers perceived it to be easier to learn psychomotor skills and attitudes from television and interactive video than from books and computers. By contrast, the viewers perceived it to be more difficult to learn verbal information and cognitive skills from television than from interactive video, computers, and books.

Motivation. There also exists some evidence that suggests that viewers' motivation will make a difference in terms of how much information they will remember from television. Brown et al. (1975) found that personal interest in further learning and in the subject matter itself was positively related to adult viewers' memory for factual information from instructional television segments.

Summary. The available research thus suggests that audience characteristics such as age, educational background, literacy level, preconceptions of the medium, and motivation can have an important impact on how well viewers will retain the information presented on television. However, the research also suggests that this is not an inevitable consequence of television per se. Often, the memory for information presented on television can be enhanced for certain viewer groups by making accommodations in the design of the television programs (e.g., eliminating redundant information, using a slower pace) or in the viewing context (allowing viewers to view the material at their own pace or to replay the program). There remain several gaps in our understanding of how audience characteristics mediate televisions' impact on literacy learning. For instance, the effects of the social and cultural background of the viewers remain to be investigated. Similarly, little is known whether and how certain audience characteristics will make a difference in terms of how television impacts on viewers literacy-related behaviors, attitudes, and skills.

Viewing Process

Television can be watched in a variety of different ways. Viewers may pay focal attention to a given program, or they may use television as background entertainment while engaged in other tasks. Sometimes viewers use the medium to inform themselves, and sometimes to be

entertained. People may watch television by themselves or they may watch with other people engaging in conversations about what they are watching. Sometimes viewers watch a given program from beginning to end, and sometimes they channel surf (switch channels), mute the program, or fast forward and rewind to skip and review parts of it.

In the typical home viewing situation, television viewing is a well-practiced habit for many adults. They approach the television medium with a set of expectations and established viewing strategies. How are people's viewing strategies related to what they learn from television? There are relatively few studies that have addressed this question yet. Efforts at understanding the impact of people's viewing strategies on their learning outcomes have concentrated on the study of active versus passive processing, and the effects of different levels of interactivity and social mediation.

Active versus passive processing. It is a common view in American society that television viewers are relatively passive when watching television. Salomon (1981) introduced the concept Amount of Invested Mental Effort (AIME) to describe this phenomenon. He distinguishes active, effortful processing that uses up limited attentional capacity and that involves conscious elaboration and inference making, from passive or shallow processing that results in little learning. Salomon (1983a, 1984) and Kubey & Csikszentmihalyi (1990) have documented that both children and adults feel more passive, uninvolved, relaxed, and unchallenged during viewing than during many other activities, and report investing less mental effort in learning from television than from print.

The amount of mental effort expended has been linked to viewers' learning outcomes. For instance, Salomon (1983a, 1984), has found that the more effort children invest in processing information presented on television, the more information they will remember. It should be noted, however, that increased mental effort does not always result in more learning. Reeves & Thorson (1986) and Cennamo (1993) suggested that a lack of a linear relationship between mental effort and learning outcomes may be due to differences in cognitive activities that occur during increases in effort. Mental effort devoted to elaborations and inferences based on the information presented may result in a breakdown of the effort devoted to comprehension, and thus learning outcomes may not increase even though the amount of invested mental effort was increased.

Salomon (1981, 1983a, 1983b, 1984) has proposed that one reason for why viewers do not concentrate much mental effort on television is related to their preconceptions about the medium. In a series of studies, Salomon (1981, 1983a, 1983b, 1984) has demonstrated that school-aged children

and college students generally perceive learning from television as easier than learning from print.

To summarize, research suggests that active, effortful processing of television results in better learning outcomes than passive processing. The amount of mental effort expended appears to be related to viewers' preconceptions about the medium. Generally, American viewers seem to perceive television as easier than print, and invest less effort to process information presented through this medium than through print. Viewers also have specific expectations about what they can and can not learn from television well, and which types of television programs may require more active processing than others. This implies that the amount of mental effort expended and learning outcomes may differ across different types of television programs. Very little is known yet about how viewers from different cultural backgrounds approach television.

Levels of interactivity. The question of how different levels of interaction with the technology (e.g., muting, rewinding/fast forwarding, channel switching) affect learning outcomes has not been systematically examined yet. For instance, it is often assumed that the user control that video technology provides (i.e., rewinding/fastforwarding) will help viewers to develop a deeper understanding of the information presented by allowing for reflection and inference making. This claim, however, has yet to be empirically substantiated.

Short of studies examining the impact of different levels of interactivity on learning outcomes, there exists some qualitative research that has produced descriptions of learner interactions with video technology. Crooks (1992) has documented the kinds of strategies that adult learners employ when using videocassettes for independent study as part of a Open University distance learning course. Interestingly, he found that students' interaction with the instructional video tapes, while diverging from the intended use, paralleled the interactions strategies described by Lockwood (1990) for students using self-instructional text. This suggests that rather than being closely tied to the format in which information is presented, students' interaction strategies may be strongly influenced by the content of the learning materials.

One consequence of the increased interactivity that new video technologies allow for is that viewers may opt for processing only part of the information presented. Understanding the effects of partial exposure to information presented on television has recently attracted the attention of advertising researchers. Gilmore and Secunda (1993) examined how the fastforwarding of commercials affects adult viewers' memory for the product information presented in them. They found that when viewers had

prior exposure to the fastforwarded commercials at normal speeds, they were able to retain some information about brand names and attributes of the advertised products. These results suggest that learning occurs even when television is fastforwarded, and that fastforwarding in fact can be useful for reinforcing previously learned materials.

Social mediation. The effects of coviewing television with other people are not well understood yet for adult audiences. However, studies that have examined the effect of parental coviewing on children have demonstrated some positive effects. For instance, adult coviewers can increase the amount children learn from educational programs such as *Sesame Street* and *Mr. Rogers' Neighborhood* (Ball & Bogatz, 1973; Salomon, 1977; Singer & Singer 1976), help children understand plot elements (e.g., Collins, Sobol, & Westby, 1981) and facilitate comprehension (e.g., Ball & Bogatz, 1973; Collins et al., 1981). Adult coviewers can also mediate some of the negative effects of violence and antisocial content by expressing disapproval and pointing out discrepancies between television reality and real life (e.g., Huesmann, Eron, Klein, Brice, & Fisher, 1983).

Researchers have proposed that verbal interaction between coviewers is primarily responsible for enhanced learning outcomes. Verbal interaction strategies that have shown to be beneficial, at least with children, include expanding upon the content of the television program, explaining vocabulary, explaining motives and plots, and expressing agreement or disagreement with communicated messages (e.g., Bryce & Leichter, 1983). Moreover, coviewers also can serve as role models for appropriate viewing behavior (e.g., Anderson & Collins, 1988). Bryce & Leichter (1983) have documented other types of social mediation that occur in the family context: informal verbal mediation in contexts outside of television viewing (such as when television is referred to and accorded a certain social status in informal conversations), and mediation by families' organization in time and space. Little is known however, to what extend these forms of mediation will affect learning outcomes, particularly for adults.

Summary. Clearly, existing research suggests that the way viewers approach television has an important impact on what they learn from the medium. However, aside from the effects of the amount of invested mental effort, we know very little about how viewing processes influence learning outcomes. For instance, we need to understand better how and what viewers learn under incidental conditions (such as when engaged in concurrent tasks while watching television) compared to intentional learning conditions (when viewers are intend on achieving a particular learning goal). Similarly, the effects of social mediation and different

levels of user control on specific learning outcomes has yet to be investigated for adult audiences. We also know very little about how viewing processes affect literacy competencies other than knowledge, that is, literacy-related behaviors, attitudes, and skills.

Design of the Television Program

There are many aspects of television programs that can be manipulated by design. As Reeves and Thorson (1986, p. 347) point out,

> *"Television messages can be divided into units that range from a single video frame to an entire program genre (McLeod and Reeves, 1980). A single frame could be defined in terms of structural properties of a picture (e.g., brightness, color, spatial frequency) or meaningful characteristics such as picture content (i.e., the "story" in a picture, its personal relevance, or aesthetic appeal). Similar descriptions could be given for increasingly large windows in the stimulus. We could talk about these same characteristics with respect to 5 seconds, 5 minutes, 30-second commercials, entire programs, entire viewing sessions, or any number of other units."*

Only a few characteristics of television programs, however, have been systematically manipulated and tested for their effectiveness to promote learning. The issues examined include the effects of different combinations of symbol systems, the effects of program pace and transience, and the effects of the presentation of content as discussed below.

Combining multiple symbol systems. Television can combine multiple symbol systems, such as visual images, sounds, music, spoken and written language, and present them simultaneously. What are the effects of presenting multiple symbol systems at the same time, and how are symbol systems most effectively combined to enhance learning?

Researchers have advanced two basic hypotheses about the effects of combining multiple symbol systems (cf., Kozma, 1991). One possibility is that the simultaneous presentation of different symbol systems (e.g., audio and visual information) will compete for limited cognitive resources and thus may reduce viewers' comprehension and memory for the information presented. Alternatively, information presented in multiple ways may work together to increase viewers' comprehension and memory. While it has been demonstrated that multi-channel presentations require more attentional capacity from the viewer than single channel presentations (Thorson, Reeves, & Schleuder, 1985), this does not necessarily imply that multi-channel presentations will impair

comprehension and memory. In support of this contention, there exist several studies that have examined how audio (verbal narration) and visual (moving images) presentations of stories separately and combined affect children's and adults' memory for the information presented (Baggett & Ehrenfeucht, 1983; Beagles-Roos & Gat, 1983; Calvert, Huston, Watkins, & Wright, 1982; Hayes, Kelly, & Mandel, 1986; Neuman, 1989). The results of these studies show that the combined use of audio and visual information does not impair subjects' memory performance and sometimes even enhances it compared to the presentation of either source alone. Thus, the simultaneous presentation of audio and visual information does not necessarily compete for cognitive resources at the expense of learning. The available evidence therefore favors the second hypothesis.

Key to the effectiveness of audio-visual presentations is how the information presented in separate channels relates to each other. The results of several studies suggest that for television programs in which the audio channel is primary, visual information can enhance learning if the information presented visually is redundant with the auditory information. Audio-visual redundancy can be accomplished, for example, by pictorially representing a spoken word on the screen. The positive effects of redundancy of information presented in audio and visual channels has been demonstrated for both children watching episodes of *Sesame Street* (Pezdek & Stevens, 1984) and adults watching news programs (Drew & Grimes, 1987; Findahl, 1971; Reese, 1983). According to Drew and Grimes (1987), the combination of redundant audio and visual information is instructionally more effective because it allows the audience to focus attention to the audio channel, where the most important information is usually found, without distraction by conflicting information from the visual channel. Redundant visual information has been shown to help clarify abstract information presented on the audio channel (e.g., Calvert et al., 1982), and to disambiguate spoken words (e.g., Baggett & Ehrenfeucht, 1983).

Hanson (1989) has suggested that a different principle may apply for television programs in which the visual channel is primary. For these programs, a low degree of redundancy may facilitate learning. This idea is supported by evidence from Drew and Grimes (1987), and Pezdek and Stevens (1984) who found that subjects who viewed non-redundant programs showed better comprehension and recall of the visual information presented. According to Pezdek and Stevens (1984), with non redundant programs viewers may focus on the visual channel because it is easier to understand and remember.

There are a few studies that have examined the use of captions in conjunction with the presentation of auditory (verbal narration and dialogue) and visual (moving images) information. Several studies have documented the benefits of captions for both children's and adults' language development (e.g., Bean & Wilson, 1989; The National Captioning Institute, 1990; Neuman & Koskinen, 1992) when screen text was redundant with the visual information. However, Reese (1983) has found that captions (especially if a lot of text appears on the screen) also can hurt learning. Hanson (1990) has suggested that the addition of text to audio and visual information may divide viewers' visual and verbal attention, and thereby decrease comprehension of and memory for the information presented. The results of these studies suggest that while captions may be beneficial, they must be used with care. The combined use of visuals, narration, and screen text may indeed put a burden on viewers' attentional capacities. It may be more advantageous to use captions with either visuals or the auditory track alone.
Other important factors that may influence how much attentional capacity will be required for the processing of captions include the speed at which text is presented on the screen, where the captions are placed on the screen, the reading level at which the captions are written, and how the content of the captions relates to the information presented through the visual and auditory channel (i.e., whether captions are used to represent dialogue, narration, actions, sound effects). These issues remain to be more closely examined by future research.

There exists some evidence suggesting that not all audiences will benefit equally from multi-channel presentations. As discussed in a previous section, Stine et al. (1990) found that older adults' recall of information was about the same after listening to an audio-only presentation and a combined audio-visual presentation, suggesting that the added visuals did not help to enhance older adults' memory. These results may be due to the limited working memory capacity of older adults, or certain processing biases.

In summary, research suggests that the use of multiple symbol systems in television programs can facilitate learning. However, different symbol systems or channels need to be combined with care. An effective strategy seems to be to make one channel primary, having it carry most of the important information, and using the other channels to present information that is redundant with the primary channel. Hanson (1990) has pointed out that many adults expect the auditory channel to be primary. In designing television programs that make use of multiple channels, it may be useful to build on adults' processing biases, and make the auditory channel primary, because this is where they will direct most of their attention. The addition of one channel to the primary one is often

sufficient to enhance learning. Using more than two channels at a time may tax viewers' attentional capacities.

Transience. Information presented on broadcast television is transient and ephemeral—it is presented continuously at a given time and pace that is not under the control of the user, and once presented, it is not retrievable other than from memory. It has been proposed (e.g., Kozma, 1991) that both the continuity and the pace of the information presented will affect comprehension and learning, but there exists surprisingly little research to support these claims.

Wright, Huston, Ross, Calvert, Tolandelli, Weeks, Raeissi, & Potts (1984) examined the effects of continuity on children's memory for television programs. They found that elementary school children who viewed high-continuity programs (programs for which scenes were interconnected) showed better recall than children who viewed low-continuity programs in which scenes were independent and unconnected (i.e., magazine formats). These results suggest that the continuity of programs does affect learning, at least for children. Whether adults are similarly affected remains to be investigated.

Program pace has been defined as the amount of information presented per unit of time. In view of the lack of empirical work in this area, Kozma (1991) has proposed a theoretical model for how program pace may affect the viewer. He suggested that comprehension and learning will be dependent on whether the cognitive pace of the learner can keep up with the program pace. Cognitive pace is defined as the amount of information processed per unit of time. Information, in cognitive psychology, is quantified in terms of chunks (e.g., Miller, 1956), whose size depends on the familiarity and meaningfulness of the information. The pace of a presentation on television is usually not sensitive to the cognitive pace of the viewer, it progresses whether or not comprehension has been achieved. Viewers who are familiar with the information presented, may be able to keep up with the program pace, even if it is fast. Moreover, if some information is missed, knowledge about a familiar domain may be used to fill in missing information from long-term memory. By contrast, if the viewer has little background knowledge, his or her chunks will be smaller and the cognitive pace will be slower, perhaps dropping below the pace at which information is presented. Since there is also less information in long-term memory that could be used to fill in missing information, this situation could quickly lead to comprehension failure.

The transience of information presented on television also can have some advantages. Kozma (1991) suggests that television programs may be uniquely suited to foster the development of dynamic mental models.

Mental models, which are usually discussed in terms of physics phenomena, are thought to be composed of a connected set of mental entities, each of which has an associated representation of its state, a set of parameters, a set of procedures that modify its parameters, and a set of relationships that connect it with other entities (Kozma, 1991). Greeno (1989) has proposed that people use mental models to make inferences and to reason through the solution of problems. For example, the observation of objects moving along paths could provide learners with the information needed to make estimates of changes in state. In addition to helping learners solve physics problems, dynamic mental models may also help learners to get a better understanding of the social world, which in turn may help them to use more effective strategies for communication, an important literacy skill. Due to the lack of research in this area, however, these considerations remain speculative.

In sum, little substantive research is available that has addressed the effects of transience of television programs on learning. Theoretical models that have been proposed to explain the effect of program pace and transience on learning can serve as guides for future research and program design.

Content. There exist a few studies that have examined the effectiveness of different kinds of content in instructional television and news programs. Of particular relevance for the present purposes are those studies that are concerned with the impact of the organization and presentation of information.

Laurillard (1991) conducted a qualitative study examining Open University students' understanding and misunderstanding of a television program that was part of their social science course. She found that viewers sometimes have difficulties integrating separate content sequences into an organized whole. Although these viewers may understand the content sequence by sequence, they have difficulties integrating them to derive main points. Laurillard found that two design strategies were effective in assisting learners to recognize the main point: First, repeatedly exemplifying the main point, and second, emphasizing it in the commentary.

Presenting information in a story format has been an effective practice for educational television programs and news casts. The story format by itself, however does not guarantee learning. Findahl and Höijer (1985) examined what kinds information adult viewers remember from news programs and how they comprehend this information. They found that news stories that referred to knowledge deriving from personal experience and dealing with human and social aspects of everyday life were remembered best. Moreover,

their results indicate that not all aspects of such stories are remembered equally well. Information about places, objects, and actors was remembered better than information about causes and consequences. These results indicate that viewers' prior knowledge and expectations play an important role in how information is understood and remembered. Findahl and Höijer suggest that based on experience with events in reality and presented on television, viewers develop schemata, or mental representations of these events, which help them to store and later remember related information.

Finally, Brown, Brown and Danielson (1975) explored how casting within a story format affects viewers' achievement and attitudes. They found that a television segment in which the presenter becomes an actor in an instructional vignette is more effective than a segment with the same content in which the same presenter is a narrator apart from the vignette. According to Brown et al. these results are due to the fact that the movement back and forth between a presenter and a vignette is too distracting for the viewers. Brown et al. were also able to identify characteristics of the presenters that enhanced viewers' learning outcomes and attitudes. Their adult subjects responded most positively to an upbeat, enthusiastic portrayal. Presenters who seemed intrinsically interested in the subject matter and eager to share knowledge with others were well received. The subjects preferred a self-assured presenter over one who suggested that the material being discussed may be difficult for the viewer and is difficult for the presenter him- or herself.

Summary. Several aspects of the design of television programs have been shown to influence viewers' memory for the information presented, including how different symbol systems are combined, the pace and continuity of a program, and its content. However, these design elements do not seem to affect all viewers in the same fashion. Whether or not viewers will be aided by the variety and pace of the information presented appears to be dependent on such factors as their age, their expectations of the television medium, and their knowledge background.

Many aspects of the design of television programs remain unexplored. The effects of the transience and pace of the information presented on television are not well understood yet. Similarly, we know very little about which genres and instructional treatments are most effective for learning. Finally, very little is known about how the design of television programs affects' viewers' lityeracy-related behaviors, attitudes, and skills.

Instructional Context

Research suggests that the nature of the instructional context in which the use of educational television is embedded is yet another important variable that mediates televisions' impact on learning. In fact, through the provision of an instructional context it is often possible to adapt a given television program to the needs of individual learners. The contexts in which adult learners may view educational television can be quite diverse, and include formal classroom settings, public spaces (e.g., in a doctor's waiting room, at the post office), and homes. Each of these contexts presents educators with different challenges and opportunities for structuring the learning experience. Research on the effects of television-supported instructional contexts is less rigorous than other research reviewed in this paper, partly because it is more difficult to isolate and control different aspects of a phenomenon as complex as a learning environment. However, available findings, even if they are anecdotal, can provide some guidance about the kinds of issues to consider in future research and the design of television-supported learning environments.

The role of television within the curriculum. Television can serve a variety of functions within a curriculum. On one extreme, a television program could represent a self-contained curriculum that does not require any additional materials or structured learning experiences. On the other extreme, a television program can serve as one of many learning materials that relate to only certain aspects of a given curriculum. How are different formats most effectively used?

The Open University has experimented with a great variety of functions for television and video in different distance learning courses. As outlined by Bates (1983, p. 65), these formats include:

- the presentation of abstract concepts through animation (e.g., in math);
- the construction of models to represent abstract ideas (e.g., in physics);
- the illustration, through a location visit, of industrial applications of chemical processes;
- the use of dramatization for enriching students' interpretation of a novel;
- the reinforcement of techniques and concepts dealt with in other components of the curriculum;
- the development of skills in using television as part of Open University studies;
- the use of television for presenting case-study material to allow students to apply theoretical concepts to real-world situations;

- the effect of co-production on the learning effectiveness of programs for Open University students.

According to Bates (1983) each of these formats has been shown to have the potential to make unique contributions to the development of students' knowledge and skills. Bates, however, is quick to point out that the use of these formats does not guarantee that learning will take place. Each of them has to meet certain conditions to insure their intended learning outcomes. Bates discusses the use of television to present case studies and to reinforce previously learned material in more detail.

The intend of the television-based case studies used by the Open University is for students to analyze them, using the theoretical or analytic constructs presented through text. While these case studies have been successfully used for students to practice and develop their analytic thinking skills, research has also documented that learners sometimes misunderstand the purpose of this kind of format, and sometimes are unable to use it in the way intended. Bates (1983) reports that some students expected the television program to provide new content or explanations for difficult theoretical concepts encountered in the course, rather than to provide material that would enable them to use the knowledge that they gained through text. Other students, even though they understood the purpose of the case studies, were unable to use them in the way intended because they seemed to lack the necessary learning skills. Thus, students may not automatically know how to use certain television formats to the best advantage, and may need help to develop the necessary skills to benefit from the use of formats that they are not familiar with.

Using television to reinforce ideas covered elsewhere in the curriculum presents another challenge. According to Bates (1983), the effectiveness of this format is dependent on how well this component of the curriculum will complement the information presented through other means, such as text. Open University students and faculty have found this format particularly useful when it is used to illustrate ideas that students have difficulties with understanding from text, such as the visual and dynamic aspects of a phenomenon. Bates recommends that an assessment of the kinds of difficulties students have with understanding target ideas should inform the design of this particular television format.

Teacher's role. Teachers can play a pivotal role in facilitating the use of educational television programs and learning. Research conducted in conjunction with the use of *Ghostwriter* materials in a variety of settings, including schools and after-school programs (Char, Miller, Isaacson, & Briscoe, 1993), suggests that teachers can enhance student learning by articulating learning goals; fostering learner's self-confidence and pride;

creating connections between the television program and learners' lives; establishing, sustaining, and reinforcing children's interest in the program; and modeling the use of the program.

Accompanying materials. There are a variety of materials that students can use in conjunction with an educational television program, including text, audio tapes, computer software, images etc. Of these materials, the use of text in conjunction with television has been most extensively discussed in the literature. However, regardless of what other materials are used in conjunction with an educational television program, the crucial issue is how well these materials are integrated.

Research conducted in conjunction with Open University distance learning courses indicates that students often find it very difficult to make connections between television and the text (cf., Bates, 1983). Moreover, students sometimes use the television components and the text in a different sequence than intended by the designers. Educators from the Open University have found that a useful strategy for dealing with these problems is to include into the television component explicit references to the text and vice versa. In fact, they found if different materials are tightly integrated with the text, students were much more likely to use different materials in the intended sequence. Interestingly, Bates points out that one reason why such explicit linking is often not done at the Open University is because television and print materials are not produced at the same time.

The Open University uses broadcast notes that are highly valued by students (cf., Bates, 1983). Broadcast notes include a summary of a television program or segment thereof, and a statement explicating the relationships between the program or segment and other materials (such as text) that are being used in the course. The intend of the broadcast notes is to orient students to the television segment, and provide them with a permanent record of it that can be used for review purposes. Open University students have found broadcast notes to be most effective if they contain a statement of the objectives, two or three main points of the program, and reprints of diagrams or tables that were shown in the program (Bates, 1983). It is important to keep the broadcast notes concise. Based Open University experience, students will not read these notes if they are too long, or read the notes but not bother to watch the television program.

The use of television programs that are intended for use in more structured classroom settings that involve a teacher may be facilitated through the provision of teacher guides. Teacher materials, however, need to be carefully designed to be effective. Research conducted on the use of *Ghostwriter* materials indicates that teacher guides are often not used

(Char et al., 1993). In this study, Char et al. found that teachers were using the learning materials itself (i.e., the television program and student text) as well as personal materials, rather than a teacher guide to come up with ideas for activities.

Activities. There is some evidence suggesting that activities that precede, accompany, and follow television viewing can help to deepen students' understanding of the learning materials (e.g., Bates, 1983; Char, et al. 1993). Previewing activities can help orient students to the television program by making them aware of its purpose and by helping students to develop and apply the necessary processing skills. Activities that accompany television viewing can help to promote active processing and keep students on task. Post-viewing activities can help students to review difficult material, to elaborate on it, and to practice newly learned skills.

The Open University uses the reading of broadcast notes as pre- and post-viewing activities (cf., Bates, 1983). Prior to viewing, the notes orient students to the purpose of the television program or segment, and state the main points to watch out for. After viewing is completed, reading of the notes helps students to review the information presented on television.

Activities that have been successfully used in conjunction with the *Ghostwriter* program include plays, writing of casebooks, and write-ins (cf., Char et al., 1993). Plays allowed learners to engage in reading, writing, and speaking, to work together as a cast, and to experience pride in their accomplishments when performing the play. Casebooks offered a place for children to write in a variety of different ways and take notes about the *Ghostwriter* episodes (e.g., about suspects, clues, evidence, problems, solutions). Casebooks were also used as writing journals, and as a place for students to express their own ideas and feelings. Write-in activities engaged students in letter writing to interact with the characters or the producers of the show.

The viewing context. The conditions under which students will view a given television program also can have an important influence on learning. For instance, as discussed in a previous section, there exists some evidence that suggests that co-viewing television with other people can have a positive effect on learning. Similarly, providing students with the opportunity to interact with the television program (e.g., through the use of video recorders or interactive laser disks) may enhance learning.

Assessment. According to research conducted at the Open University (cf., Bates, 1983), including the television component of a curriculum into the assessment is an important strategy for educators to enhance the perceived relevance of the television program among their students. Bates

emphasizes that the assignments upon which assessment will be based need to be carefully designed. He proposes that the key to this lies in the identification of the skills that are specifically intended to be developed by the television program, and to design assignments based on these learning goals. Sometimes it is possible to incorporate assignments for assessment directly into the television program.

Broadcasting schedule Research conducted on the television components of Open University distance learning courses and on the effectiveness of commercials suggests that the time and frequency at which programs are being broadcast can make an important difference for viewing and learning.

According to Bates (1983), there are both diurnal and seasonal variations in viewing rates for Open University television programs. For these programs, viewing rates were found to drop when their broadcast time was moved from the evening hours to earlier parts of the day. Viewing was also found to decrease during the summer period due to vacations and summer schools, and at the end of the school year when students are busy preparing for exams.
Clearly, an evening broadcast time seems to fit best into the structure of adult learners' lives. However, while adult learners may prefer to watch educational television during the evening hours, this time may not be the most optimal for learning. Research conducted on how viewers' memory for information presented in television commercials differs depending on broadcast time suggests that their immediate memory for information presented is superior in the morning (Hornik, 1989).

In addition to the significance of broadcast time, Bates (1983) also stresses the importance of repeat broadcasts. The re-broadcasting of episodes or programs that were previously shown has been demonstrated to enhance the likelihood that learners will view the program, and may allow slower learners to review difficult material.

Summary. The nature of the learning environment or instructional context in which the use of an educational television program is embedded can have an important influence on learning. While there exist only a few studies that have examined the role of the instructional context in learning from television, it is clear from these studies that the use of and effective learning from a given television program is dependent on how well the program integrates with the curriculum, teachers' roles, other learning materials, activities, the viewing context, assessment practices, and the broadcasting schedule.

Summary and Recommendations for Design

Available research suggests that television has considerable potential for learning in general and for literacy education in particular. Television has been shown to influence viewers' behaviors, attitudes, knowledge, and skills. Research conducted in conjunction with existing literacy programs has demonstrated that television can induce viewers to engage in literacy practice, to change their attitudes about literacy, and to learn words, numbers, and reading and math skills. Perhaps the most important message, though, that can be derived from available research is that whether or not learning occurs, is dependent on a variety of factors, including who is doing the watching, how the watching is being done, what is being watched, and in what kinds of activities the viewing is embedded.

The design of the television program and the curriculum needs to take these factors into account. Bryant, Alexander and Brown (1983, p. 27), in concluding their review of educational television programs for children (such as *Sesame Street*, *The Electric Company*, *Feeling Good*, *3-2-1 Contact*, *Freestyle*, *Vegetable Soup*) nicely emphasize this point, when they state:

> *"The programs that appeared to be most successful in achieving their goals began with extensively examined, well-defined goals packaged in well-produced, entertaining programs appropriately aimed for the target audience. For programs that achieved the most successful educational results, supplemental components accompanied the telecasts: classroom use of programs and home visits by supporting staff members were useful, but an essential "supplemental" ingredient was effective promotion of the program. And, finally, the most difficult aspect of the formula for the educator/producer to provide, cooperative viewing and discussion at home was a consistently important factor in learning from educational television."*

Given the diversity of the adult literacy audience it may not be possible to develop one program or one curriculum that accommodates all. Program development efforts may need to be focussed on one subgroup of this audience. Alternatively, program development efforts could be diversified by developing multiple programs for multiple viewing contexts. In addition, the use of video technology (allowing for viewer interaction with the television program) and the integration of the television program into a structured learning environment can help to individualize instruction to some extend, especially to compensate for the effects of learners' age and literacy levels.

Research suggests that the way viewers approach the television medium has an important impact on what they learn from the medium. The more actively viewers process the information presented, that is, the more effort they expend at elaborating the materials presented and making inferences based on them, the more they will learn. Active viewing can be encouraged in multiple ways. For example, the design of the television program could incorporate requests for the learner to perform certain content related tasks (e.g., to read captions or to solve problems). Since little is known about which kinds of tasks may be effective, they need to be carefully selected and tested for their effects to insure that they will achieve the intended outcomes. Active viewing could also be encouraged through the instructional context or learning environment in which the television program is embedded. This may include emphasizing that the purpose for watching the television program is educational, engaging students in reflective activities such as note taking on or discussion about the television program, teaching active television viewing skills as part of the curriculum, making use of video technology (e.g., VCR) that allow for learner interaction with the television program, and promoting co-viewing and peer mediation among learners.

Based on existing research, several recommendations can be derived for the design of educational television programs for adults. Overall, design efforts should be aimed at making the program accessible to a variety of learners besides encouraging them to elaborate on the content. Research has shown that the presentation of information through different symbol systems or multiple channels simultaneously can enhance comprehension and learning. However, the combination of multiple channels must be done with care in order not to tax viewers' attentional capacities. Research suggests that only if there is a high degree of correspondence between the information presented through different channels will learning be enhanced. An effective strategy for achieving such correspondence is to have one channel carry the primary message, and present redundant information in the other channels. Since adult viewers tend to expect that the primary message is being carried by the auditory channel, it may be useful to make the auditory channel primary. Alternatively, if a different channel is chosen to carry the primary message, viewers may need to be alerted to this fact so that they may direct their attention accordingly.

Another crucial aspect in the design of a television program is its pace. Designers need to select a pace that is slow enough so that the audience can keep up with it, and at the same time fast enough so that it will hold viewers' attention. For an audience as diverse as adult literacy learners, the ideal program pace will vary to a great extend between different learners. In order to accommodate a large number of learners, it may be most useful to select an intermediate pace, and make special provisions for

slower learners to review the materials (e.g., encourage video-taping and reviewing the program at home; engage slower learners in special review activities in more structured classroom settings). In addition, programs should include undemanding segments following complex ones to allow viewers to assimilate and make sense of the information presented before additional important information is added. Elements such as music or explanatory examples can give viewers time to make inferences and elaborate on the information presented.

The selection and organization of the content present yet another set of design issues for educational television programming. Research suggests that materials that relate to viewers' personal experience and deal with the human and social aspects of real life are remembered best. Programs that embed target literacy skills in contexts that are familiar to the viewers may therefore be most effective to hold their attention. The challenge for designers will be to select content that is both familiar yet challenging and interesting enough to capture adult viewers' interest. Research also suggests that the organization of information can have an important impact on how well it is remembered. Useful design strategies for helping viewers recognize the main point of a program include its repeated exemplification, and emphasizing it in the commentary.

The design of television-enhanced learning environments should be aimed at three major goals: To adapt the television program to individual students' needs, to clarify information presented and to deepen learning, and to help students to approach the medium. A key to an effective learning environment is to integrate the television component with all its other components, including the curriculum, teachers' roles, other learning materials, activities, the viewing context, assessment practices, and the broadcasting schedule.

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